Marine
Laboratory
Aberdeen

SCOTTISH FISH FARMS

Annual Production Survey, 1995

THE SCOTTISH OFFICE
Agriculture, Environment
and Fisheries Department

FOREWORD

Responses from Scottish rainbow trout and Atlantic salmon farming companies to a SOAEFD questionnaire covering the period January-December 1995 are summarised in this report. The cooperation of the fish farming industry in completing the questionnaire is gratefully acknowledged. Copies of the questionnaire are included in Appendix I(a-c)

The report is structured to allow readers to follow trends within the trout and salmon industries in addition to providing information on the latest production year. Data from previous years have been reassessed and modified where necessary.

Under the Registration of Fish Farming and Shellfish Farming Business Order 1985 all companies engaged in fish farming in Scotland are required to register with SOAEFD. The registers are maintained by the Fish Health Inspectorate based at the Marine Laboratory, Aberdeen. The contents of the registers cannot be made public (Diseases of Fish Act 1937 as amended), however company and site information can be published in summary form and these are shown in the appropriate tables. Because of the small numbers of farms culturing other species in Scotland eg. turbot, charr, tilapia and eels it is not possible to record details of production without identifying the sources of information. Brown trout production, which is believed to be used exclusively for restocking, was not covered by the questionnaire.

An outbreak of Viral Haemorrhagic Septicaemia (VHS) on a land based turbot farm using pumped ashore seawater on the island of Gigha was reported in the 1994 Production Survey Report. The outbreak was contained and no other farms were infected. Application of EU Fish Health Regulations under 91/67/EEC however meant that the island of Gigha was removed from the GB Approved Health Zone and remains so until re-approval can be obtained. The source of the infection was not identified but reservoirs of virus have been found in wild marine fish by scientists of the Marine Laboratory. Marine sources of VHS are continuing to be investigated by SOAEFD and results will be published as they become available.

An amendment to current legislation, titled The Deregulation (Salmon Fisheries [Scotland] Act, 1868) Order 1996, has been passed by parliament and recently come into effect. Under the terms of section 18 of the original Act it is a criminal offence to buy, sell, expose for sale or have in possession any salmon roe. The purpose of the Act is to protect wild salmon which spawn in Scottish rivers. The new Order will now permit the sale of farmed salmon ova for human consumption (salmon caviar). It is possible that this new Order will affect salmon grower companies production strategy in that fish may be ongrown specifically for ova production.

I. RAINBOW TROUT

II. ATLANTIC SALMON

Ova and Smolts

Production fish (Salmon)

SUMMARY

Rainbow Trout

In 1995 a total of 54 companies using 69 sites produced 4,683 tonnes of rainbow trout, an increase of 420 tonnes on the 1994 tonnage. The bulk of production (61%) was of fish weighing <450g (<1lb) but a significant proportion (26%) were of the bigger size grouping >900g (>2lbs). Most of the production was for thetable trade (87%) whilst the remainder (13%) was for the restocking trade. All ova laid down in 1995 were either all female diploid (94%) or triploid (6%) stock. The industry again relied heavily on non-GB supplies of ova (97%). The number of staff employed at 132 full-time and 64 part-time was a slight decrease on 1994. Strathclyde continued to be the Region with greatest trout production. Vaccines were widely used but fewer fish were vaccinated.

Atlantic Salmon

A further increase of 9% in annual production to 70,060 tonnes was made by the industry in 1995. This was achieved exclusively in the grilse and pre-salmon components of the 1995 harvest by increases in numbers harvested (more input of smolts and probably better survival) and by an increase in the mean weight of each fish. The salmon component remained static. Mean weights of grilse and pre-salmon were 3.31kg and for salmon 4.27kg compared to 3.11 and 4.28 respectively for the previous year. There was a great similarity in mean weights of fish in each of the categories recorded in the survey for each of the 5 Scottish Regions where salmon are produced which suggests market requirements dictate size at harvest.

The most notable feature of the results was the 90% overall survival of the 1993 year class of smolts. Since 1989 when survival was at a minimum of 58% due largely to the bacterial disease furunculosis survivals have increased annually. This is attributed to the efficacy of the new furunculosis vaccines. On a regional basis 3 of 5 Regions had 95% smolt survival or more but Strathclyde although showing an improvement was low relative to the rest at 74% even allowing for some smolt movements into the neighbouring Highland region before harvest. Some of these losses were due to escapes resulting from storm damage. However the 95% or more in other Regions shows what is possible. Many of the remaining losses in these Regions occurred due to death in the first summer of sea life some 2-5 months after transfer to sea water. The causes of these deaths remain unknown but are thought to be related to loss of ability to withstand high salinities.

For the first time in several years smolt numbers put to sea increased significantly, by 24 % to 26.786 million. It is estimated this should result in an increase in production to in excess of 80,000 tonnes in 1996. Some 2.5 and 0.6 million were $S^1/_2$ and $S1^1/_2$ respectively 'out of season smolts' again showing further increases on the previous year. Numbers of staff increased by 4.4% to 1355. The industry productivity in tonnes produced per man was 52 much as last year. Numbers of sites producing >500 tonnes was 45 compared to 16 in 1992 when they had 30% of production compared to 58% in 1995. Weight of fish produced at 9.5 kg/m3 of cage net capacity was the same as last year suggesting the industry paid head to warnings not to allow increased production at the expense of increased stocking density.

I. RAINBOW TROUT (*Oncorhynchus mykiss*)

Annual production survey questionaires were sent to all 54 cmpanies currently registered with SOAEFD as being actively engaged rainbow trout *(Onchorynchus mykiss)* production in Scotland in 1995. A return was received from all the companies and information obtained covering all 104 sites presently held on the Fish Farm Register.

Production

Production of rainbow trout was directed entirely at the UK table and restocking markets. Production was reported from 59 grower sites, one more than in 1994. A further 10 sites reported production solely for fry and fingerlings for ongrowing, these are discussed later in the Report. Trends in production tonnages over 1985-1995 are shown in Tables 1a-d and in Figure 1.

TABLE 1a
Total production (tonnes) of rainbow trout in 1985-1995 and % change relative to the 1985 production level

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Tonnes	2,256	2,316	3,207	3,556	3,512	3,183	3,334	3,953	4,023	4,263	4,683
Change	-	+3	+42	+58	+56	+41	+48	+75	+78	+89	+108

In 1995 production increased by 420 tonnes compared with 1994 and was the greatest ever recorded in Scotland. Conditions for growth were good and there were no significant disease problems. In the last eleven years the total tonnage of rainbow trout produced has more than doubled.

TABLE 1b
Production (tonnes) for the table trade in 1992-1995

Year	<450 g <1 lb	450-900 g 1-2 lb	>900 g >2 lb	Total tonnes	% change from 1992
1992	2,666	144	645	3,455	–
1993	2,481	272	764	3,517	+1.8
1994	2,376	288	1,038	3,702	+ 7.1
1995	2,736	199	1,149	4,084	+18.1

Production for the table trade in 1995 increased by 382 tonnes (11%) compared with 1994, which had shown a 5% increase over 1993. Small, portion size fish weighing <450g (<1lb) continued to form the bulk of the table trade and accounted for 2,736 tonnes (58%) of the total pduction. Demand by the table trade for fish in the 450-900g size range was limited, decreasing by approximately one third. Demand for large fish weighing >900g (>2lbs) increased by 111 tonnes compared with 1994. The increase was due in part to stock build-up on a number of farms at the end of 1994. The outlet for large fish as in previous years was primarily for smoking.

TABLE 1c
Production (tonnes) for the restocking trade in 1992-1995

Year	<450 g <1 lb	450-900 g 1-2 lb	>900 g >2 lb	Total tonnes	% change from 1992
1992	187	256	55	498	–
1993	124	346	36	506	+ 1.6%
1994	125	337	99	561	+10.9%
1995	107	411	81	599	+20.3%

Restocking of fishing ponds, lochs and resevoirs for recreational angling continued to be increasingly important to the rainbow trout rearing industry and accounted for 13% of the total production, 20% greater than the quantity sold for restocking in 1992. Fish weighing 450-900g (1-2lbs) continued to be preferred size for restocking and demand for this size of fish increased by 74 tonnes. This was in contrast to the table trade where demand for fish of this size was relatively low. Demand for small fish (<450g, [<1lbs]) and larger fish (>900g, [>2lbs]) decreased, both categories showing a drop of 18 tonnes compared with 1994. It is evident that anglers preference for medium sized fish has a large influence on the size of fish produced for the restocking trade.

Recreational fisheries are not classed as fish farms. The production figures given above refer to stocking and not to catches taken by anglers.

Production by Site

Trends in the scale of production by grower sites grouped according to their production tonnages during 1992-1995 is shown in Table 1d.

TABLE 1d
Numbers of sites grouped by production tonnage in 1992-1995

Year	Number of sites per production tonnage <1-25	26-100	>100	Total Number of sites
1992	30	12	16	58
1993	28	13	16	57
1994	25	15	16	56
1995	26	15	18	59

The total number of grower sites in production over 1992-1995 has fluctuated between 56 and 59. Over the last 4 years the number of sites producing <25 tonnes annually has tended to decrease whilst there has been an increase in the number of sites producing >25 tonnes, from 30 to 26 and from 28 to 33 respectively. This suggests there has been a tendency for individual sites to increase their level of production.

Method of Production

A grouping of sites in relation to tonnages produced by the main methods of production and comparison of production levels in 1994 and 1995 is shown in Table 2.

TABLE 2
Grouping of rainbow trout farms by production tonnages by the main methods of production in 1995 and comparison with production in 1994.

Production method	Production grouping (tonnes) in 1995 0*	<10	10-25	26-50	51-100	>100	Total tonnage & (%) by method 1994	1995	No.* of sites 1994	1995
FW cages	0	2	1	2	0	8	1,792 (42)	2,058 (44)	13	13
FW ponds & raceways	0	2	2	4	4	6	1,516 (36)	1,512 (32)	19	18
FW tanks & hatcheries	10	9	7	3	2	2	484 (15)	679 (15)	35	33
SW cages	0	1	2	0	0	2	474 (9)	432 (9)	5	5
Total	10	14	12	9	6	18	4,263	4,683	72	69

*includes all sites active, eg hatcheries and ongrowing sites

As in previous years production was again principally in freshwater, using either cages or ponds and raceways. Cage production in 1995 increased by 340 tonnes (+20%) whilst production by ponds and raceways showed little change compared with 1994. Freshwater cage production in 1995 accounted for 44% of the total production whereas the proportion produced by ponds and raceways has dropped to 32%. Production by other freshwater methods increased by 195 tonnes to 679 tonnes, equivalent to 15% of the total. Production in seawater decreased by 42 tonnes and accounted for only 9% of the total production.

Production facilities

A number of different production facilities may be employed on a site, these range from various types of egg incubator and troughs for alevins and fry (included here under hatchery units) to tanks, ponds, raceways and cages. Many trout sites are capable of rearing from egg through to adult fish. The exception is cage sites which hold only grower fish. The number of the production facilities at any time is liable to vary as sites enter or leave the industry and/or modify their modes of operation. The numbers of production facilities recorded on the 69 active sites reported in 1995 was:

Hatchery units	**24**
Ponds & Raceways	**32**
Tanks	**39**
Freshwater cages	**16**
Seawater cages/raceways	**5**

Company and Site Data

The number of companies and sites registered with SOAEFD as being actively engaged in rainbow trout farming during 1992-1995 are listed in Table 3.

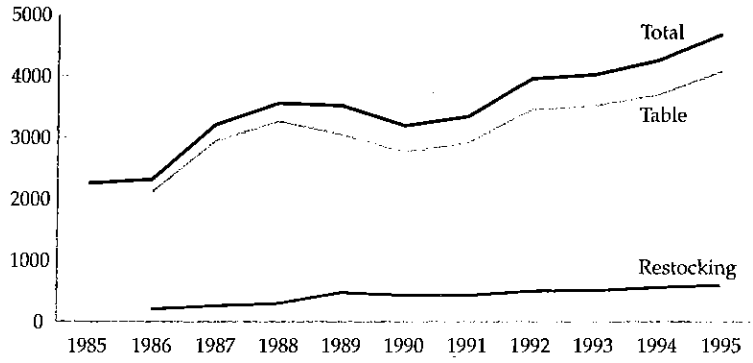
TABLE 3
Number of production companies and sites in 1990-1995

Year	No of companies	No of sites
1990	59	71
1991	56	69
1992	53	72
1993	52	74
1994	56	72
1995	54	69

In 1995 one new trout company entered production whilst 3 companies ceased to operate. The latter 3 companies were all small producers whose scale of operations rendered them economically unviable. Some hatchery facilities are used to rear salmon and/or rainbow trout dependent on the company's business strategy. In 1995 two hatcheries previously holding salmon were restocked with rainbow trout ova whilst another two hatcheries rearing rainbow trout in 1994 reverted to smolt production in 1995.

The total number of rainbow trout sites registered with SOAEFD was 104. Of these 80 were classed as active, although only 69 were in production. Of the remaining 35 sites - 11 were not in production, 22 were recorded as inactive and 2 as undeveloped.

Figure 1 : Production (tonnes) in 1985-1995



Staffing and Productivity

The number of staff employed full and part-time in production of rainbow trout in 1990-1995 is given in Table 4.

TABLE 4
Number of staff employed in trout production in 1990-1995

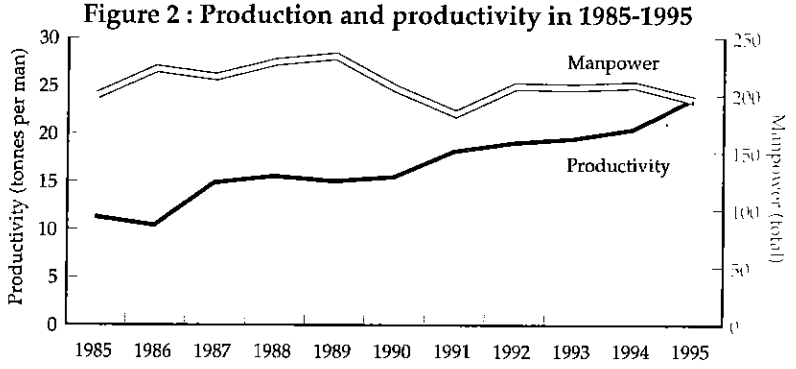
Year	Full-time	Part-time	Total
1990	138	68	206
1991	133	51	184
1992	135	73	208
1993	134	73	207
1994	139	70	209
1995	132	64	196

The total number of staff employed in 1995 was 196, a decrease of 13 over 1994. This comprised 7 full-time and 6 part-time satff and was at least in part due to there being 2 fewer companies in operation in 1995.

Productivity

Estimates of productivity were derived by dividing total production by the number of staff employed. No distinction was made between full and part-time staff. Trends in manpower employed and productivity 1985-1995 are shown in Figure 2.

Figure 2 : Production and productivity in 1985-1995



Productivity in 1995 was 23.9 tonnes/man, an increase of 3.6 tonnes/man over 1994. Reduced staffing and increased production accounted for this improvement. The underlying factors were the use of improved feeds and application of improved husbandry techniques.

Production and Manpower by Region

The geographic distribution of Rainbow trout production within Scotland by Region is shown in Table 5 and Figure 3.

TABLE 5
Staffing, production, fry and fingerling trade and number of fish vaccinated by Region in 1995

Region	Staff		Production tonnage		No. (000s) fry and fingerlings		No (000s) fish
	F/T	P/T ted	Table	Restock	Bought	Sold	vaccinated
Combined*	12	10	37	96	180	139	130
Borders	9	5	378	50	1,409	-	962
Central	19	9	679	85	2,793	-	2,763
Dumfries and Galloway	25	7	880	112	2,053	1,823	1,427
Highland	15	8	361	36	1,082	669	1,235
Strathclyde	48	16	1,203	132	2,469	1,018	3,240
Tayside	17	8	460	93	3,585	7,440	3,535
All Scotland	132	64	4,084	599	13,132	10,912	11,828

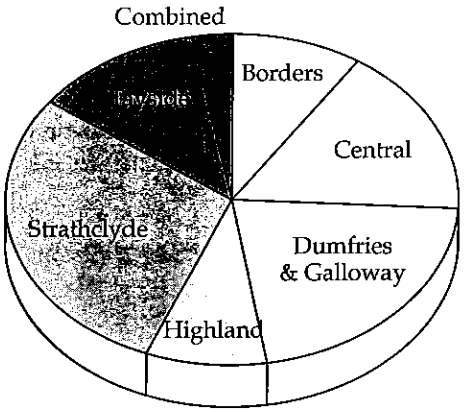
*Combined include Lothian, Fife, Grampian and Western Isles Regions

In 1995 production increased in all Regions. The greatest tonnage was produced in Strathclyde Region (1,335 tonnes) followed by Dumfries & Galloway (992 tonnes), with lesser quantities being produced in Central (764 tonnes), Tayside(553 tonnes), Borders (428 tonnes) and Highland (397 tonnes); other Regions produced a combined total of 133 tonnes.

The number of staff employed tended to reflect the respective tonnages produced. The proportion of fish sold for the table and restocking trades varied between the Regions, the latter tending to reflect the abundance and demands of local fishery interests.

The trade in fry and fingerlings showed the local importance of hatchery and fry and fingerling units. These units may solely supply other commercial ongrower sites or may themselves ongrow to produce commercial tonnages. Vaccination was widely used throughout Scotland.

Figure 3 : Proportion (%) production by Region in 1995



Ova Sources

Trends in the number of eyed ova laid down for hatching during 1993-1995 and ova sources are given in Tables 6a-c.

TABLE 6a
Number (000s) and sources of ova laid down for hatching in 1993-1995

	GB broodstock			Non-GB broodstock			
Year	Own stock	Other GB stock	Total GB	Northern hemisphere	Southern hemisphere	Total foreign	Grand total
1993	1,830	405	2,235	12,815	4,694	17,509	19,744
1994	479	625	1,104	13,055	5,445	18,500	19,604
1995	165	360	525	12,485	7,825	20,310	20,835

The number of eyed ova laid down for hatching was 1.2 million (6%) greater than in 1994. This suggests a high level of confidence in the industry and increased production tonnages should be expected over the next year(s). The industry however has become almost totally dependent on supplies of ova from outwith the GB Approved Health Zone. The proportion of ova laid down for hatching originating from GB broodstock has decreased from 11% of the total in 1993 to only 2% in 1995. For ova originating in the Northern Hemisphere 79% were from Isle of Man and Northern Ireland sources, the remainder coming from Denmark.

Although the demand for ova is being met at present it should be noted that the actual number of producers specialising in ova production is limited. Being dependent on a small number of specialised producers could present problems to the industry. Broodstock may be held for 6 years covering 5 consecutive spawnings and if kept in unprotected waters such stock may be increasingly prone to endemic diseases such as BKD or IPN, the causative agents of both being vertically transmissible ie. via egg. Should an ova producer suffer a major disease outbreak this could result in a severe shortage of ova. In the longer term it is also possible that if ova producers were to concentrate on a limited number of selected stocklines this could result in a reduction in the size of the overall gene pool.

Imports of Ova

Since 1993 movements of live fish, ova and gametes within and into the EU (formerly EC) have been controlled by Council Directive 91/67/EEC. Northern Ireland, Isle of Man and parts of Denmark, as Member States of the EU, have been granted Approved Health Zone Status similar to that of GB in respect of IHN and VHS viruses. In addition a limited number of farms on mainland Europe have recently been granted Approved Health Status. Companies wishing to import ova from Approved EU Member States, or Approved farms, **must give prior notice** of any shipment into Scotland to SOAEFD Marine Laboratory in Aberdeen. No imports of a commercial nature are permitted from EU Member States or farms not having Approved Health Status. Imports from Third Countries such as South Africa are **only permitted under licence** and following rigorous testing by the official authorities in the originating country.

Imports of eyed ova from Southern hemisphere sources allows farmers to lay down ova throughout the year. By careful husbandry growth can be regulated to produce a constant supply of fish to meet particular market requirements eg. portion size fish for the table trade. Numbers and sources of ova imported into Scotland in 1994 and 1995 are given in Table 6b.

TABLE 6b
Number and source of ova imported into Scotland in 1994-1995

Source	1994	1995
Northern Ireland	6,255,000	6,185,000
Isle of Man	2,950,000	3,500,000
Denmark	3,850,000	2,650,000
South Africa	5,445,000	7,825,000
Total	**18,500,000**	**20,160,000**

In 1995 imports from the Isle of Man increased by 20% and from South Africa by 44% compared with 1994. Imports from Northern Ireland remained relatively constant whilst those from Denmark decreased by 31%. The decrease in imports from Denmark reflected farmers preference and ova availaility.

In the Northern hemisphere ova production is concentrated during Autumn-Spring period. Although attempts have been made to produce out of season ova there continues to be a gap in supply during the summer months. Table 6c illustrates clearly how this gap in supply from the Northern hemisphere sources has been overcome by obtaining ova from Southern hemisphere sources.

TABLE 6c
Number and source of ova imported and number of import consignments(-) into Scotland by month in 1995

Month	Northern Ireland	Isle of Man	Denmark	South Africa
January	1,500,000 (8)	-	-	-
February	1,320,000 (5)	700,000 (2)	-	-
March	1,480,000 (5)	-	-	-
April	100,000 (1)	-	1,750,000 (4)	-
May	- (-)	-	900,000 (1)	-
June	280,000 (3)	-	-	3,165,000 (7)
July	25,000 (1)	-	-	4,410,000 (12)
August	350,000 (1)	-	-	250,000 (1)
September	280,000 (3)	-	-	-
October	550,000 (4)	-	-	-
November	300,000 (2)	1,500,000 (2)	-	-
December	- (-)	1,300,000 (3)	-	-
Totals	**6,185,000 (33)**	**3,500,000 (7)**	**2,650,000 (5)**	**7,825,000 (20)**

In addition 6,000 ova for experimental purposes were imported from South African and 300,000 fingerlings from Northern Ireland sources.

Type of ova

In recent years there has been a trend towards increased use of all female diploid ova, this is illustrated in Table 7.

TABLE 7
Number(000s) and proportions(%) of ova types laid down for hatching in 1992-1995

Year	Total ova	All female diploid Nos (%)	Triploid Nos (%)	Mixed sex diploid Nos (%)
1992	21,408	18,099 (85%)	796 (4%)	2,513 (12%)
1993	19,744	17,261 (87%)	1,396 (7%)	1,087 (6%)
1994	19,604	18,105 (92%)	1,134 (6%)	365 (2%)
1995	20,835	19,546 (94%)	1,170 (6%)	119 (+%)

The trend towards stock derived from all female ova in recent years was evident again in 1995. All female diploid ova accounted for 94% of all ova laid down for hatching, an increase of 1.4 million over 1994. Over 1992-1995 the proportions of ova stock types laid down has changed significantly, all female stock has increased from 85% to 94% whilst mixed sex diploids has decreased from 12% to <1%, the proportion of triploids having remained relatively constant at 4-7%. The principal advantage of triploidy is the suppression of maturity. As most of the Scottish production is for the table trade and demand is mostly for small fish (weighing <450g), there is little advantage in rearing triploids. For growers in the restocking trade, however, there are obvious advantages in producing large non-breeding fish and the extra costs and effort involved in producing tripolids may be justified.

Trade in fry and fingerlings

Within the rainbow trout industry there is a considerable trade in the fry and fingerling stages between hatchery/first-grower sites and on-growing sites. A measure of this trade is shown in Table 8.

TABLE 8
Trade in numbers (000s) of fry and fingerlings* bought and sold in 1992-1995

Year	Fry and fingerlings bought(000s) All female diploids Nos. (%)	Triploid Nos. (%)	Mixed sex diploids Nos. (%)	Total number bought	Total number sold
1992	8,993 (84%)	617 (6%)	1,101 (9%)	10,711	10,447
1993	8,395 (73%)	917 (8%)	2,239 (19%)	11,551	9,823
1994	9,854 (90%)	1,017 (9%)	47 (+%)	10,918	10,379
1995	12,449 (95%)	683 (5%)	0 (0%)	13,132	10,912

*Includes trade in small fish of somewhat greater size than is traditionally associated as fry or fingerlings ie. up to 80g.

The numbers of fry and fingerlings bought increased by 2.2 million (20%) in1995 compared with 1994. Purchases of all female diploid stock accounted for 95% of all fish bought, the remaining 5% being triploids. No purchases of mixed sex diploids were recorded. The tendency for the fry and fingerling trade to concentrate on all female stock mirrored the trend in ova stock type laid down for hatching and further demonstrated the industry's preference for all female diploid stock.

There was a small increase of 533,000 (5%) in the number of fry and fingerlings sold. The imbalance in trade between fry and fingerlings bought and sold is to be expected as they apply to different areas of the industry. In general supply of juvenile rainbow trout cannot be met within Scotland and additional supplies are obtained from sources in England and Wales.

Use of Vaccines

Vaccines are widely used in the rainbow trout industry as preventative treatments against infectious diseases. The most commonly employed vaccines are those used to combat enteric redmouth (ERM) infections, caused by the bacterium Yersinia ruckeri. The number of sites rearing fish vaccinated against ERM in 1985-1995 is shown in Table 9.

TABLE 9
Number of sites rearing fish vaccinated against ERM in 1985-1995

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
No. of sites	-	16	20	21	21	27	30	33	28	35	31

In 1995 a total of 11.8 million fish were reported vaccinated, a decrease of 258,000(-2%) compared with 1994. 9.7 million fish were bought vaccinated whislt the remaining 2.1 million were vaccinated on the receiving site. The total number of fish currently held on Scottish rainbow trout farms is high, it is hoped that the present decrease in use of vaccines does not indicate complacency amongst growers.

CONCLUSIONS

The increase in rainbow trout production recorded over 1992-1994 was sustained in 1995 when production increased by approximately 10%. Portion size fish for the table trade dominated production whilst a significant proportion was for the restocking trade. Although total production increased there was a further decrease in the number of small producers suggesting a concentration of production amongst fewer companies. Productivity increased significantly caused in part due to a drop in the number of staff employed.

The numbers of ova imported and ova laid down for hatching increased slightly. Most ova came from outside the GB Health Zone but almost half originated from within the British Isles. "Out of season" ova from the Southern Hemisphere are now an essential part of the industry's strategy for all year production. Industry showed a distinct preference for all female diploid stock at the expense of normal mixed stock diploids. There was a buoyant trade in fry and fingerlings.

II. ATLANTIC SALMON (*Salmo salar*)

As before the survey covering Atlantic salmon (*Salmo salar*) production is divided into two sections, a report on ova and smolt production and the corresponding figures from the sea water based operations on salmon production. The responses from the producers have been excellent and we are pleased to record 100% return from the registered sites.

A. Ova and Smolts

Production and staffing

The number of smolts produced, staff employed and smolt productivity, measured as the mean number of smolts produced per man employed (full-time plus part-time staff combined), during 1986-1995 is given in Table 10 and Figure 4.

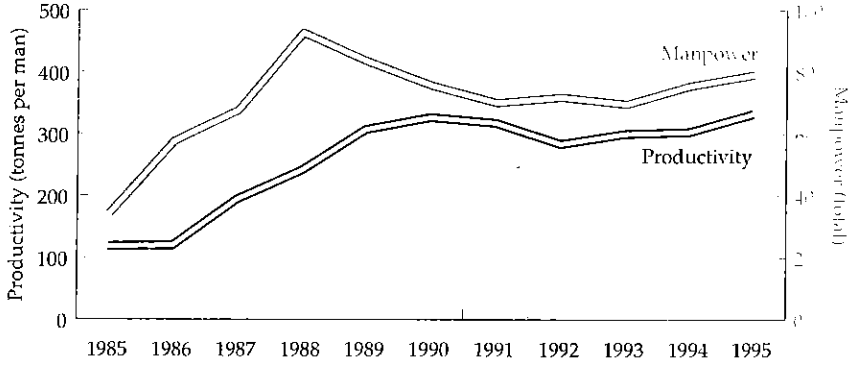
TABLE 10
Number(000s) of smolts produced, staff employed and smolt productivity in 1986-1995.

Year		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Production: Total smolts produced (000s)		7,030	13,294	22,499	25,825	24,875	22,404	20,527	21,043	23,117	26,540
Staffing:	full-time	196	248	344	330	285	271	266	233	245	279
	part-time	92	90	119	87	93	79	93	115	133	117
	Total staff	288	338	463	417	378	350	359	348	378	396
Mean No smolts (000s) produced per man		24.4	39.3	48.6	61.9	65.8	64.0	57.2	60.5	61.2	67.0

Total numbers of smolts produced in Scotland in 1995 increased by 3.4 million to 26.5 million compared with the 1994 total of 23.1 million. The total number of staff employed in smolt production increased by 18 to 396, continuing the upward trend evident since 1994; staff in full-time employment increased by 34 whilst those in part-time employment decreased by 16. Smolt productivity increased by 5,800 smolts per man, continuing the upward trend evident since 1992. Productivity in 1995 was the greatest ever recorded and was 2.7 times greater than in 1986. The increases in staff in full-time employment and in productivity indicate a current high level of confidence in this section of the industry and also improved efficiency in rearing methods. Smolt production however is likely to continue to be driven by demand from the salmon growing sector of the industry.

Overall production of smolts in 1995 increased by 15% and a similar order of magnitude of increase in production can be anticipated in salmon as these fish mature to market size. This increase will be in addition to any gains in efficiency eg. in increased survival or growth in existing stocks.

Figure 4 : Manpower and productivity in smolt production in 1985-1995



Photoperiod adaptation

Adult salmon generally spawn during the period October-January, ova from these spawnings generally hatch some 12-weeks later and give rise to smolts which are ready to put to sea a year later in the following spring. The standard terminology for smolts having spent one year in freshwater is S1 and those spending two years in freshwater is S2. Natural smolting is driven by the seasonal patterns of temperature and light. By light manipulation (photoperiod control) smolting may be advanced outwith the natural smolting times and growth can be manipulated by controlling water temperature and varying feeding regimes. Nowadays smolts are available for relocation to seawater as early as 6 months after first feeding.

A number of smolt producers have recently installed technologically advanced water recirculating systems which allow ready manipulation of both photoperiod and temperature. By careful husbandry stocking densities in these units can be greatly increased and growth advanced to allow earlier transfer of parr, or alternatively the production of larger parr, to ongrowing cage or tank systems. By using early and late spawned ova it is possible to have two throughputs of ova to alevin/parr in the one season.

Smolts may be described as $S^1/_2$, S1, $S1^1/_2$ and S2 stages, the $S^1/_2$ and $S1^1/_2$ stages usually reflecting fish undergoing some environmental manipulation. However the timing of going to sea is not exact and fish may go to sea as early as October with cohorts possibly transferring any month thereafter. The number of smolts produced by above definitions in 1992-1995 are shown in Table 11.

TABLE 11
Number of smolts (000s) produced by age group stage in 1992-1995

Year	$S^1/_2$	S1	$S1^1/_2$	S2	Total
1992	-	20,586	-	707	20,828
1993	686	19,698	202	457	21,043
1994	1,672	20,712	511	222	23,117
1995	2,663	22,705	365	806	26,540

The advantage of using photoperiod adapted smolts in conjunction with normal smolts is that harvest schedules are made more flexible by allowing a better continuous match of fish size with market demand. Early "out of season" smolts may also be produced by extracting the top sizes from normal growing populations. It should be noted that although the production period in photoperiod adapted smolts may be reduced, additional costs for eg. lighting, heating may be incurred.

Generally S1 and S2 smolts are larger and more robust than their $S^1/_2$ and $S1^1/_2$ siblings whose survival in seawater has been variable and poorer in comparison. The early placement of parr into freshwater cage or tank systems increases the length of the period of greatest natural growth during spring-autumn and gives rise to a bigger size of smolt. Historically S1 smolts weighing 30-40gms were put to sea, with modern production methods S1 smolts weighing in excess of 80gms are now commonly produced.

Company and site data

The total number of companies and sites engaged in smolt production in Scotland in 1992-1995 are given in Table 12.

TABLE 12
Number of production companies and sites in 1992-1995

Year	No of companies	No of sites
1992	74	137
1993	73	138
1994	68	147
1995	69	162

In 1995 the number of companies registered with SOAFD and engaged in smolt production increased by 1 to 69. This increase was due to one company (hatchery) switching from rainbow trout production to smolt production. The current trend is towards a concentration of smolt production under the control of fewer companies. Care should be applied when interpreting the above data as several companies operate under a

number of different names for business reasons. Some companies specialise solely in rearing smolts for sale, others rear smolts for ongrowing on their own sea sites whilst others do both.

The total number of smolt sites registered with SOAFD in 1995 was 221, an increase of 2 over 1994. Of the 221 sites, 162 sites were reported in production, an increase of 15 compared with 1994; 12 sites were reported not in production ie. not in use or fallow, 42 were officially classed as inactive and 5 as experimental. The greater number of sites in production reflected the greater production of smolts in 1995.

Although the current trend is to increase smolt production using water recirculation systems, the number of sites not in production plus those classed as inactive suggests that there is still potential for increased smolt production using traditional methods.

Production systems

The production systems employed in smolt rearing fall into two groupings, namely tank systems (including ponds and raceways) and cage systems. The number of each system in use in 1992-1994, their cubic capacity and the number of smolt produced are given in Table 13a. Estimates of stocking density derived from the total numbers of smolts produced per cubic meter holding capacity are given in Table 13b.

TABLE 13a
Number of smolt production systems, capacity and the number of smolts (000s) produced in 1993-1995

System	No of sites with systems			Total capacity (000s) cubic metres			No of smolt produced (000s)		
Year	1993	1994	1995	1993	1994	1995	1993	1994	1995
Hatcheries, tanks, ponds and raceways	83	85	95	41.5	54.3	58.9	10,862	10,873	11,480
Cages	55	62	67	213.5	275.6	266.2	10,862	12,244	15,060
Total	138	147	162	255.1	329.8	325.1	21,043	23,117	26,540

TABLE 13b
Stocking density (number of smolts produced per cubic meter) in 1993-1995

Year	1993	1994	1995
Tanks	245	200	195
Cages	51	44	57

57% of smolts were reared on cage sites in freshwater lochs. The primary advantage of this system is its cheapness to operate. Tank systems have the advantages that producers can directly observe their stock and react accordingly, environmental conditions can be controlled/modified (eg. temperature, photoperiod) and operations like grading carried out with reduced handling thereby reducing stress in the fish. Tank systems are disadvantaged in that they are capital intensive, may depend on pumps and outside energy sources and be labour intensive and expensive to operate. Stocking density in tank systems however has been considerably greater than in cages and has this tended to offset production costs. Since 1993 the stocking density in tank systems has tended to decrease, from 245 to 195, whilst density in cages has fluctuated between 51-57 smolts per cubic meter. These estimates do not take into account smolt size or biomass. It is likely that stocking density in tanks will increase again as more producers install high density recirculation systems.

A number of types of rearing system may be present on a site. These range from various types of egg incubators and troughs (classed here as hatchery units) for alevins and fry to tanks, ponds, raceways and cages. The number of systems available on the 162 producing sites reported in 1995 was:

Hatchery	71
Tanks	99
Ponds and raceways	5
Cages	72

The number and cubic capacity of the rearing systems on a site are liable to fluctuate according to the farmer's work plan.

Ova production

Scotland is a major producer of salmon ova both for the home industry and for export. As spawning extends over October to January the data on ova production presented in Tables 14a-b (below) relate to spawning periods rather than to the calender year. The numbers of ova laid down for hatching in 1985-1995 are shown in Figure 5.

TABLE 14a
Number of ova produced (000s) in 1991/92 -1994/95

Year	1991/1992	1992/1993	1993/1994	1994/1995
No of ova	118,432	93,517	98,900	89,556

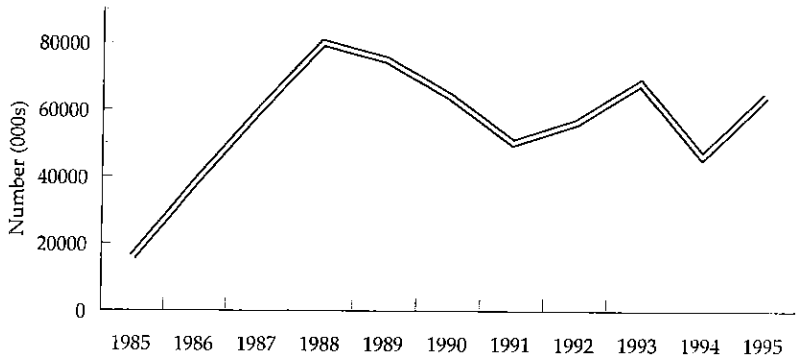
The number of ova produced in 1994/95 was 89.6 million. This was a decrease of 9.3 million (9%) compared with 1993/94 and continued an apparent downward trend evident since 1991/92. Indications are that ova production in 1995/96 may have been somewhat lower but all data are not yet available.

TABLE 14b
Ova sources and number of ova (000s) laid down for hatching in 1992-1995

Year	Own stock	Other GB farm stock	GB wild	Foreign	Total	Previous year estimate
1991-92	32,824	23,722	310	-	56,857	-
1992-93	44,524	19,281	514	4,381	68,699	54,415
1993-94	25,883	14,991	450	5,347	46,672	49,064
1994-95	37,176	25,063	475	2,160	64,873	46,538
1995-96	-	-	-	-		(71,635)

The total number of ova laid down for hatching in 1995 increased by 18.2 million(39%) to 64.9 million and was an increase of similar magnitude on producers' forward estimate made in 1994. There were significant increases in the number of ova derived from producers' own stock and also from other GB, principally Scottish, stock. Imports from foreign sources decreased by 60% to 2.1 million, equivalent to 3% of the total ova laid down. In 1994 foreign ova accounted for 13% of the total ova laid down for hatching. As in 1993 and 1994 there were no reports of sites stocking all female or triploid ova. Producers forward estimate for ova to be laid down for hatching in 1996 is 71.6 million.

Figure 5 : Numbers of ova laid down for hatching in 1985 – 1995



International trade in ova

The international trade in ova is unrestricted as such but is controlled by the presence or absence of certain infectious fish diseases within exporting farms and receiving areas. Following the introduction of the Single EU Market on 1 January 1993 and the associated Fish Health Regulations common to all Member States, a trade in live salmon and ova has been established. The extent of this trade is shown in Tables 15a-b.

TABLE 15a
Number and sources of ova imported in 1993-1995

Source of import	No of ova imported 1993	1994	1995
OVA			
EU Member States	4,439,000	5,823,400	1,470,000
Australia	470,000	240,000	600,000
Total	4,909,000	6,063,400	2,070,000
PARR			
EU Member States	0	72,000	2,662,000

The Republic of Ireland was the main source of supply of both ova and parr. A large proportion of the parr imported in 1995 was to compensate for a loss of eyed ova due to equipment malfunction and associated mortalities. The decrease in ova imported suggests that Scottish salmon growers are satisified with the type and quality of smolt produced in Scotland.

Note 1: **GB is a zone of high health status for fish, all imports of live fish or fish eggs from Third Countries must conform to the same health status and are permitted only under licence.**

2: **All movements of live fish or fish ova within the EU between zones of equivalent health status require inspection by the official health authorities and must be accompanied by official Movement Documents; movements from zones of higher to lower health status do not require official inspection nor specific movement documentation other than labelling to ensure their nature, source and destination; SOAEFD should be informed at least 2-3 days in advance of any movement being made.**

3: **Exports to Third Countries are governed by the health requirements of the importing country, prospective exporters are advised to ensure they are fully aware of these requirements before entering into export contracts.**

The export of eyed salmon ova is of considerable importance to the industry. Exports of ova are generally made during December-March once ova have "eyed-up". In addition to the trade in farmed fish ova there is a also small trade in wild fish ova, exports of wild ova generally being targetted at restocking European river systems. The number and destination of ova exported in 1994-1996 are given in Table 15b.

TABLE 15b
Numbers(000s) of farmed and wild ova and parr exported from 1993-1995 spawnings

Spawning period	Export year	Farmed Origin Chile	EU	Others	Total	Wild origin Total
OVA						
1993/94	1994	9,467	7,540	40	17,047	450
1994/95	1995	22,691	7,242	40	31,833	450
1995/1996*	1996	17,542	7,937	20	25,499	635
PARR						
1995	-	374	-	374	-	-

* The numbers given for 1995/96 may be subject to revision.

Exports of parr were first recorded in 1995. It is unclear whether the trade in parr will expand in coming years. The Republic of Ireland was the major recipient market within the EU for both ova and parr.

Exports of ova in 1995/96 were 25.5 million, some 6.3 million fewer than in 1994/95. The reason for this drop in ova exported was due in one instance to a loss of broodstock following storm damage and associated mortalities but more generally to an apparently low spawning success rate in 1995/96 rather than to a lack of market demand. The reasons for the low spawning success rate are not fully understood but may have been environmentally related, water temperatures recorded during summer-autumn were the highest ever experienced on Scottish salmon grower sites.

Ova uptake

Historically the numbers of ova produced have exceeded smolt and salmon producers requirements. Excess ova, namely ova not laid down for hatching, were discarded. The establishment of an export trade in ova has been an additional outlet for ova producers and is likely to become increasingly important as recent legislation allows farmed salmon ova to be placed on the market for human consumption (as salmon caviar). An estimate of the quantity of ova discarded can be obtained from the number of ova laid down for hatching (producers own stock) plus ova exported in relation to total ova production.

The percentage of ova discarded in 1993, 1994 and 1995 were 46%, 57% and 23% respectively and illustrate the uptake of excess ova by the export market.

Ova and smolt production records

A record of the number of ova laid down for hatching annually in 1987-1995 is given in Table 16 and is compared with the ova producers estimates for that period. Also included in Table 16 are the number of smolts produced and the smolt producers estimates for 1987-1997.

TABLE 16
Number (000s) of ova laid down for hatching and smolt production records and estimates in 1987-1997

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Ova (000s) laid down for hatching:											
Producers data*	60,107	80,386	75,327	64,559	50,720	56,857	68,699	46,672	64,874	-	-
Producers estimate for that year	58,573	67,475	85,077	90,839	50,406	60,442	54,415	49,064	46,538	-	
Smolt production (000s):											
Salmon growers data	12,858	20,921	23,839	21,408	20,277	20,527	20,541	21,552	26,785	-	-
Smolt producers data*	13,294	22,499	25,825	24,874	22,404	20,828	21,043	23,116	26,540	-	-
Smolt producers estimate for following year	15,119	23,094	28,740	26,242	24,058	21,503	21,756	22,130	25,191	31,734	-
Smolt producers estimate for two years ahead	-	21,697	28,213	33,621	28,011	26,363	22,290	24,422	24,064	27,461	37,295
Number of ova laid down per smolt produced*	4.5	3.6	2.9	2.6	2.3	2.7	3.3	2.0	2.4	-	-

*based on smolt producers data

The number of ova laid down for hatching annually has fluctuated, ranging from 46 to 80 million whereas the number of smolts produced has shown progressive increases from 21 to 26 million. Likewise survival from ova to smolt, given here as the number of ova laid down per smolt produced, has fluctuated but averages out at around 2.6. These figures reflect the culling of potential S2s as well as mortality.

The number of smolts produced in 1995, 26.5 million, was approximately 1.4 million more than the producers estimate made in 1994 and some 2.5 million more than their estimate made in 1993. These estimates are accurate to approximately 5% and 10% respectively. Producers forward estimates indicate an annual increase of 20% in smolt production in 1996 and 18% in 1997. There was close agreement between salmon producers data for the number of smolts put to sea and the smolt producers data for the number of smolts produced.

Scale of smolt production

The number of smolts produced per site has tended to vary in relation to site location, water supply, market demand, company size and company production strategy. Indications of changes in the scale of production can be obtained by grouping sites in relation to the number of smolt produced, as shown in Table 17.

TABLE 17
Number of smolt producing sites grouped in relation to the number(000s) of smolts produced in 1987-1995

Year	1-10	10-25	26-50	51-100	101-250	251-500	501-1,000	>1,000	No of sites in production	Total smolts produced
1987	45	18	16	20	16	10	5	1	131	13,294
1988	6	18	23	28	30	13	12	1	131	22,499
1989	7	18	20	16	37	20	10	3	131	25,825
1990	3	15	19	20	29	19	9	4	118	24,874
1991	2	11	17	22	26	26	5	2	111	22,404
1992	3	8	14	17	41	23	4	0	110	20,828
1993	1	9	15	17	32	21	9	0	104	21,043
1994	4	5	13	24	37	17	13	0	113	23,117
1995	1	6	15	29	30	26	14	1	122	26,540

Table 17 refers only to sites producing smolts, all sites holding only ova, fry and/or parr are excluded. Over the time period review there has clearly been a reduction in the number of sites producing 50,000 or less smolts annnually. Although the number of smaller producing sites in 1995 and 1994 were broadly similar there was distinct increase in 1995 in the number of sites producing 250,000 or more smolts.

Ova and smolt production by Region

Ova and smolt production tend to be concentrated within certain geographic regions. Previously availability of natural water supplies determined the location of sites but with the introduction of water recirculation systems even small water supplies may be used for significant smolt production. A breakdown of staff employed, ova laid down for hatching and smolt production by Region is given in Table 18 and illustrated in Figures 6a-c (see page 21).

TABLE 18
Number of staff employed, ova laid down for hatching and smolt production by Region in 1994-1995 and estimated in 1996-1997

	No. staff employed		Ova(000s) laid down for hatching		Smolt production		Smolt estimated production(000s)	
REGION	F/T	P/T	1994	1995	1994	1995	1996	1997
Combined *	15	6	2,930	3,335	797	1,294	1,266	1,820
Highland	158	58	20,903	36,127	11,558	13,449	16,475	19,605
Orkney	5	5	1,780	1,200	445	501	529	622
Shetland	25	13	3,200	4,316	1,150	947	1,280	2,210
Strathclyde	61	21	10,328	9,553	5,440	5,222	6,909	6,944
Western Isles	21	15	7,530	10,342	3,727	5,127	5,275	6,095
All Scotland	285	118	46,538	64,874	23,117	26,540	31,734	37,296

* Includes Central, Dumfries & Galloway, and Tayside Regions - there was no production in Grampian or Borders Regions.

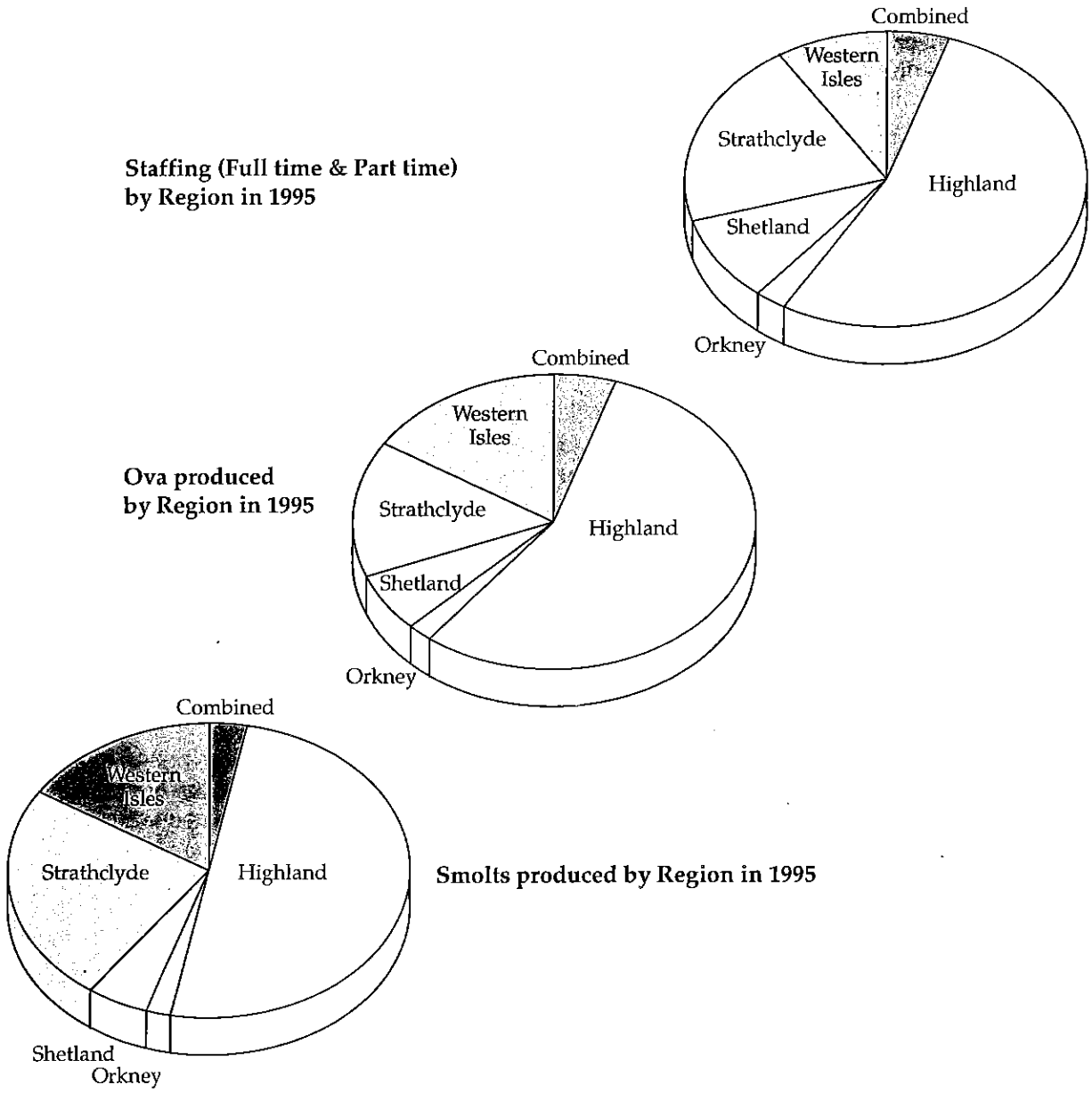
Vaccines

In recent years furunculosis, a systemic infection caused by the bacterium *Aeromonas salmonicida*, was a major cause of mortality in salmon at sea and led to concentrated research to produce an effective vaccine. A number of relatively successful vaccines have been developed and are now commercially available. Vaccination is by injection and producers tend to vaccinate fish prior to smolting. A number of producers also bath vaccinate parr against Enteric Redmouth disease (ERM), caused by the bacterium *Yersinia ruckeri*, which can cause mortailities in young fish in freshwater. The number of sites using furunculosis and ERM vaccines (recorded here for the first time) and fish vaccinated in 1986-1995 is given in Table 19.

TABLE 19
Number of sites using furunculosis and ERM vaccines in 1986-1995

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Furunculosis	3	8	29	65	59	61	71	73	85	102
ERM	-	-	-	-	-	-	-	-	-	28

Figure 6 : Staffing, ova and smolt production by Local Government Region in 1995



Fry and parr

In addition to the production and trade in salmon ova there is a considerable movement of salmon fry and parr between sites in Scotland. Some sites are used solely for first feeding and early juvenile stages whilst others are used for ongrowing to smolting. The extent of the movements of fry and parr is shown in Table 20.

TABLE 20
Number (000s) of fry and parr moved between sites in 1992-1995

Year	Number (000s) of fry and parr removed	
	Into sites	Out of sites
1992	32,018	29,444
1993	33,330	30,778
1994	32,478	29,648
1995	42,462	39,211

The numbers of fry and parr moved between sites was relatively stable during 1992-1994 but in 1995 the numbers moved increased by some 30%. These figures largely represent movements between hatchery and tank sites and cage sites and rather than a commercial trade per se. The increase in numbers moved in 1995 mirrored the increase in smolt production in 1995.

B. Production fish (Atlantic Salmon)

In the wild salmon fishery smolts having spent one winter at sea and returning to spawn in the following year are called grilse whereas those spending two winters at sea and returning the following, or subsequent, years are called salmon. In salmon farming all harvested fish are now called salmon. However a proportion of farmed salmon still grilse ie. mature after one sea winter, and as records of numbers and gross weight of these fish are kept by industry, they were recorded in the survey. In seeking production information for the survey it has been practice also to record the numbers and gross weight of fish harvested up to December of the year surveyed in two categories corresponding to the year of smolt input, called pre-salmon and salmon.

Production

Annual production in Atlantic salmon is given as the combined tonnage of all age groups harvested in a calender year. Trends in production by year class and category are shown in Tables 21a-d and Figure 7.

TABLE 21a
Weight of salmon (tonnes) harvested annually in 1985-1995

Year	Tonnes	Year	Tonnes
1985	6,921	1991	40,593
1986	10,337	1992	36,101
1987	12,721	1993	48,691
1988	17,951	1994	64,066
1989	28,553	1995	70,060
1990	32,351	1996	83,300(est)

The weight of salmon harvested in 1995 was 70,060 tonnes, the greatest ever recorded in Scotland and an increase of 5,994 tonnes (9%) compared with 1994. Since 1985 annual production has increased steadily except in 1992 when there was a drop in production due to heavy mortalities attributed to furunculosis, a systemic infection caused by the bacterium *Aeromonas salmonicida.*

TABLE 21b
Number(000s) and weight (tonnes) of fish harvested and mean fish weight (kg) per smolt year class in 1993-1995

	Year of smolt input	Year of harvest	Production		
			Number (000s)	Tonnes	Mean weight (kg)
Harvest of <1-year old fish (ie. in year of smolt input)	1993	1993	46,500	78	1.7
	1994	1994	260,514	388	1.5
	1995	1995	206,618	369	1.8
Harvest of 1-year old fish (1 sea winter)	1992	1993	11,102	32,738	2.95
	1993	1994	13,446	41,865	3.11
	1994	1995	14,420	47,775	3.31
Harvest of 2-year old fish (2 sea winters)	1991	1993	4,675	15,975	3.40
	1992	1994	5,096	21,812	4.28
	1993	1995	5,137	21,916	4.27

The trend to harvest fish in the same year as smolt input (fish under 1-year old) halted in 1995 and showed little change from 1994. There was a significant increase in tonnage of 1-year old fish harvested (nearly 6,000 tonnes) whereas the tonnage of 2-year old fish was constant. Since 1992 mean fish weight has increased and reflects the effectiveness of furunculosis vaccines, enhanced growth rates due to improved feeds and feeding methods (eg. high protein diets, automatic feeding systems) and continuing improvements in husbandry practices, particularly those aimed at reducing stress in the fish (eg. air lift morts removal, swim through at net change). Other important factors have been the application of management schemes to avoid the introduction of infections eg. fallowing, group agreements on single age group stocking over extended areas and stocking with smolts of common health status. Additional factors influencing performance are the size of smolt and the time these are put to sea.

The harvesting of young or small fish (<1-year old) has advantages in that it allows farmers to reduce stocking densities by selling fish or to meet specific market demands. The weight at harvest in older fish reflects

marketing requirements eg. for smoking, fresh fillets and whole fresh fish.

TABLE 21c
Proportion of annual production (% weight) by growth stage in 1993-1995

Year Growth stage	1993	1994	1995
Input year fish	<1%	<1%	<1%
Grilse	26%	27%	32%
Pre-salmon	41%	38%	37%
Salmon	33%	34%	31%

There has been a trend since 1993 for a greater proportion of the annual harvest to consist of grilse whilst the proportions harvested as pre-salmon and salmon have decreased.

TABLE 21d
Weight (tonnes) and number (000s) of grilse and pre-salmon harvested annually in 1993-1995

Year	Grilse (Jan - Aug)			Pre-salmon (Sep - Dec)		
	Number (000s)	Tonnes	Mean weight(kg)	Number (000s)	Tonnes	Mean weight (kg
1993	4,969	12,739	2.56	6,133	19,999	3.26
1994	6,435	17,386	2.70	7,011	24,479	3.49
1995	7,610	22,235	2.92	6,809	25,540	3.75

The number, tonnage and mean weight of grilse and pre-salmon has increased annually since in 1993. The increases in 1995 were in part due to advantageous growth conditions but over the longer term the figures demonstrate salmon growers ability to produce more and larger fish in successive years.

Survival and production in smolt year classes

Smolts put to sea in one year may be harvested later that year, in the following year or 2-years later. The total number of a year class harvested is a measure of survival in that year class from the time of input into seawater to the time of final harvest. Survival and production (harvest) in smolt year classes put to sea in 1984-1995 are shown in Table 22.

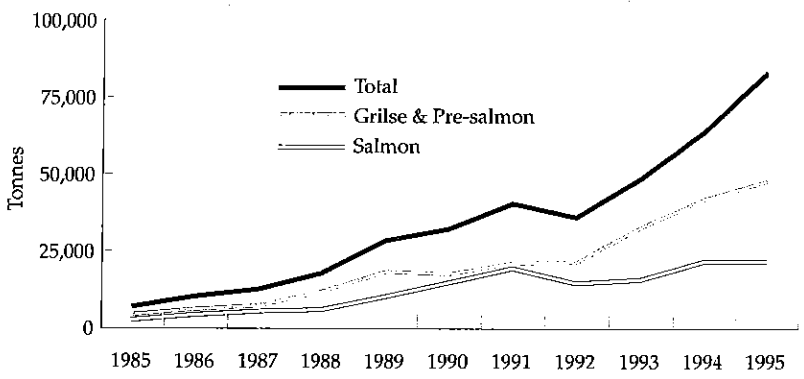
TABLE 22
Atlantic salmon production record by smolt year class in 1984-1995

Year of smolt input (000s)	No of smolts input	Year of harvest	No of grilse and pre-salmon (000s)	Weight (tonnes)	Mean fish weight (kg)	% of fish recovered as grilse and pre-salmon	Year of harvest	No of salmon (000s)	Weight (tonnes)	Mean fish weight (kg)	% of fish recovered as salmon	Total % of fish (all ages) recovered	Year class weight (tonnes)
1984	3,628	1985	1,970	4,262	2.163	54.3	1986	1,168	4,350	3.723	32.2	86.5	8,612
1985	5,586	1986	2,409	5,988	2.486	43.1	1987	1,522	5,521	3.627	27.3	70.4	11,508
1986	6,595	1987	3,285	7,200	2.143	49.8	1988	1,750	6,086	3.480	26.5	76.3	13,286
1987	12,858	1988	5,167	11,866	2.300	40.2	1989	3,267	10,312	3.156	25.3	65.5	22,178
1988	20,921	1989	7,890	18,240	2.312	37.7	1990	5,382	14,891	2.770	25.7	63.4	33,131
1989	23,829	1990	7,683	17,459	2.272	32.2	1991	6,123	19,567	3.196	25.7	57.9	37,026
1990	21,408	1991	8,877	21,026	2.368	41.5	1992	4,315	14,728	3.413	20.1	61.6	35,754
1991	20,227	1992	8,864	21,373	2.410	43.8	1993	4,675	15,875	3.396	23.1	66.9	37,248
1992	20,527	1993	11,102	32,738	2.949	54.1	1994	5,096	21,812	4.280	24.8	78.9	54,550
1993	20,541	1994	13,446	41,865	3.114	65.5	1995	5,006	21,336	4.268	24.4	89.8	63,231
1994	21,552	1995	14,420	47,775	3.313	66.9	-	-	-	-	-	-	-
1995	26,786	-	-	-	-	-	-	-	-	-	-	-	-

In the last year for which smolt survival can be calculated, 1993, survival was the highest (89.8%) recorded since 1984 and showed a considerable and continuing improvement over the previous period, largely it is considered due to a great reduction in furunculosis by vaccine therapy. The harvesting of 66.9% of the 1994 year class in 1995 raises the question as to how many of this year class is left for harvesting in 1996. If survival of the 1994 year class remains at 24% (1993 level) and harvest weight also remains constant (4.2kg), the 1994 year class will contribute some 21,700 tonnes to the harvest in 1996, approximately the same as in 1995. Other factors affecting production in 1996 are the survival and growth of the 1995 smolt year class and how many

of these will be harvested in 1996 as grilse and pre-salmon and at what weight. There were 24% more smolts in the 1995 year class which, if culling (67%) and weights (mean 3.3kg) are similar to the 1994 year class, they will contribute 59,200 tonnes to the 1996 harvest. On these calculations the projected harvest tonnage for 1996 is 80,900 tonnes. Farmers forward estimate for the weight of harvest in 1996 is somewhat more optomistic at 83,300 tonnes.

Figure 7 : Annual production (tonnes) of grilse, pre-salmon and salmon in 1985-1995



Survival and production in smolt year classes by Region

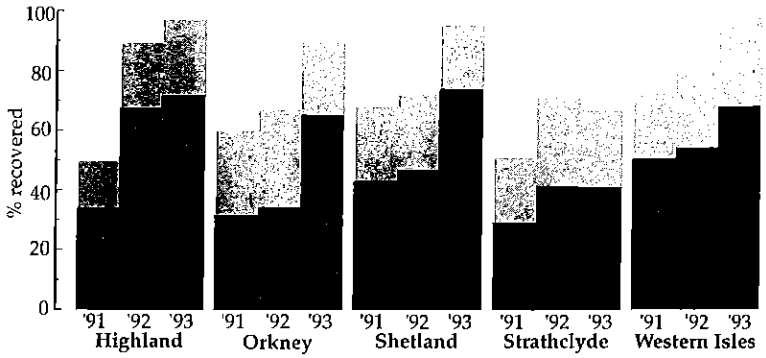
Trends in survival in smolt year classes, derived from the numbers harvested as grilse, pre-salmon and salmon in 1991-1995 in Scottish Regions producing salmon are given in Table 23 and Figure 8.

TABLE 23
Number(000s) of smolts put to sea, number and percentage of each year class surviving to harvest plus production tonnage *in 1991-1995 by Region

Region	Smolts to sea (000s)		Grilse and pre-salmon recovered			Salmon recovered			Total survival (recoveries)		Total production in 1995	Estimated production in 1996
	Year	No	Year	No	%	Year	No	%	No	%		
Highland	1991	11,107	1992	3,755	33.8	1993	1,730	15.6	5,485	49.4	22,509	32,286
	1992	7,650	1993	5,160	67.5	1994	1,647	21.5	6,807	89.0		
	1993	7,560	1994	5,405	71.5	1995	1,927	25.1	7,394	96.2		
	1994	7,914	1995	4,721	59.7							
	1995	9,427										
Orkney	1991	746	1992	236	31.6	1993	208	27.9	444	59.5	1,903	2,852
	1992	681	1993	236	34.7	1994	217	31.9	453	66.5		
	1993	731	1994	478	65.4	1995	176	24.2	654	90.0		
	1994	824	1995	399	48.4							
	1995	1,127										
Shetland	1991	4,643	1992	2,012	43.3	1993	1,135	24.4	3,147	67.8	15,523	18,264
	1992	5,014	1993	2,342	46.7	1994	1,248	24.9	3,590	71.6		
	1993	4,554	1994	3,354	73.6	1995	993	21.6	4,347	94.7		
	1994	4,812	1995	3,055	63.5							
	1995	5,811										
Strathclyde	1991	4,597	1992	1,355	29.5	1993	981	21.3	2,336	50.8	15,227	24,147
	1992	3,989	1993	1,667	41.8	1994	1,182	29.6	2,849	71.4		
	1993	5,582	1994	2,300	41.2	1995	1,215	25.7	3,515	74.2		
	1994	5,453	1995	2,994	54.9							
	1995	6,437										
Western Isles	1991	2,946	1992	1,506	51.1	1993	620	21.0	2,126	72.2	14,348	11,450
	1992	3,195	1993	1,742	54.5	1994	802	25.1	2,544	79.6		
	1993	2,804	1994	1,909	68.1	1995	825	29.4	2,734	97,4		
	1994	4,002	1995	3,252	81.3							
	1995	3,983										

*excludes the relatively small numbers of fish harvested in the year of input in 1993-1995

Figure 8 : Proportions (%) of 1991-1993 smolt year classes recoverd by Region



In all Regions survival in the 1993 smolt year class, the last full year class harvested, was greater than in the 1992 and 1991 year classes. This was particularly evident in Highland, Shetland and Western Isles Regions where survivals of 95% or greater were reported. The greater the proportion of the year class harvested as grilse and pre-salmon however means that there are proportionally fewer left in the sea to be harvested as salmon. The apparently lower survival in Strathclyde Region compared with other Regions was due largely to grade culling and company policy on stocking densities but a number of young fish were moved outwith the Region for ongrowing (inflating survival in Highland Region), a number were lost as escapees following storm damage whilst others were held over as broodstock and have not been included under Strathclyde production. No large disease problems were reported in any of the Regions thus accounting for the great increase in numbers of fish harvested (as % recovered).

Over 1991-1994 the proportion of smolt year classes harvested as grilse and pre-salmon increased annually in all Regions. In 1995 the proportion of the 1994 year class harvested in 1995 tended to vary between Regions - Strathclyde and the Western Isles reported increases whilst Highland, Shetland and Orkney Regions reported decreases. The differences in harvest composition now largely tend to reflect producer companies growing and marketing strategies rather than biological or environmantal factors in a particular Region.

Smolts to sea

Traditionally smolts were put to sea in April-June at age 12 or 24 months but the introduction of photoperiod adaptation has resulted in smolts being ready to put to sea throughout the year. The number of smolts at age approximately 6, 12, 18 and 24 months, put to sea in 1992-1995 is given in Table 24, smolts purchased from English sources are included.

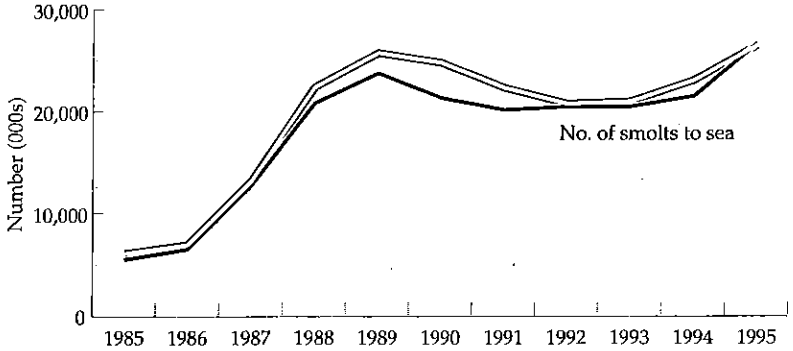
TABLE 24
Number (000s) and origin of smolts put to sea in 1992-1995

Year	Smolts to sea				Total (000s)	England origin	
	S1/2	S1	S1 1/2	S2		(000s)	%
1992	-	19,418	-	1,109	20,527	992	5
1993	-	19,843	-	698	20,541	827	4
1994	1,865	19,301	113	274	21,553	1,451	7
1995	2,442	23,081	589	674	26,786	852	3

The total number of smolts put to sea in 1995 (26.7 million) was 5.23 million (24%) more than in 1994. The majority of smolts in 1995 (23 million, 86%) were S1s as in previous years but there were also increases in the numbers of S1/2, S1 1/2 and S2s put to sea. Some 97% of smolts were of Scottish origin, the remaining 3% coming from sources in England. The increase in numbers of smolts put to sea reflects a growing consumer uptake and therefore appreciation of fresh salmon and also a need amongst growers to achieve greater throughput with existing facilities in order to achieve greater efficiency to meet the downward trend in salmon price.

Historically the numbers of smolts put to sea annually, as recorded by the salmon growers, has tended to be less than the numbers of smolts produced as recorded by the smolt producers (ref. Table 10). In 1995 there was broad agreement between the two sets of data, the salmon growers recording some 250,000more than the smolt producers. The relationship between the numbers of smolts put to sea and the number produced in 1985-1995 is shown in Figure 9.

Figure 9 : Numbers (000s) of smolts produced and put to sea in 1985-1995



Fallowing

Fallowing involves the removal of all fish and nets from sea cage sites and is used as a method of cleansing/ resting sites. The number of sites and duration of fallowing periods in 1993-1995 are shown in Table 25.

TABLE 25
Number of sea cage sites employing a fallow period in 1993-1995

		Fallowing period (weeks)					
Year	0	<4	4-8	8-26	26-51	≥52	Total
1993	135	7	47	74	13	86	362
1994	118	13	48	64	12	103	358
1995	110	14	60	73	6	91	354

110 sea cage sites held fish throughout 1994, 153 sites were fallowed for a varying number of weeks whilst 91 sites were reported as having no production. Most of the latter were part of a planned fallowing cycle. SOAEFD continues to advise companies to incorporate a fallow period in growing cycles to break any cyclical disease that might be present and recommend that the fallowing period should be as long as possible.

The survey questionaire did not distinguish how many of the 110 sites not fallowed held one or more year classes although it is understood that single year class stocking is common practice. SOAEFD recommenmd that all grower sites should be stocked with a single year class and that this should cover extended areas such as west coast sea lochs.

Company and site data

The number of salmon growing companies registered with SOAEFD and the number of grower sites operated in 1992-1995 are given in Table 26 and Figure 10, fallow sites are listed as having no production.

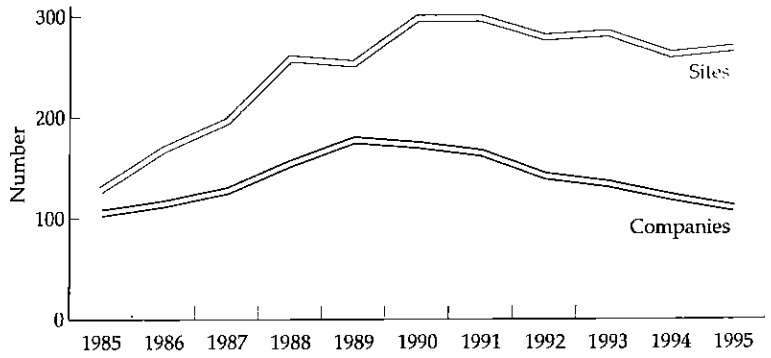
TABLE 26
Number of companies and sites engaged in salmon production in 1992-1995

Year	Number of companies			Number of sites		
	Producing	No production	Total	Producing	No production	Total
1992	140	6	146	279	68	347
1993	132	12	144	283	86	369
1994	119	12	131	262	101	363
1995	108	12	120	268	91	359

In 1995 a total of 120 salmon growing companies were registered with SOAEFD. The number of companies producing salmon was 108 and was 11 fewer than in 1994 and further demonstrated the trend for production to be concentrated amongst a smaller number of companies, evident since 1992. 12 companies reported no production. As with smolt producing companies, care must be taken when interpreting the above data as some of the larger producers have not only incorporated a number of smaller companies within their operations but have also retained the small company names for business reasons. In addition a number of companies have entered into contract growing arrangements, either in full or in part, which operate under their own name but may be under the control of the contracting company.

A total of 430 salmon grower sites were registered with SOAEFD in 1995. In addition to the 268 producing and 91 fallow (no production) sites, a further 71 sites were officially classed as inactive or undeveloped.

Figure 10 : Numbers of companies and sites actively engaged in salmon production 1985–1995



Staffing

The operations of producer companies can range from only salmon production to processing and marketing. The questionaire specifically asked for returns of staff associated solely with the producing process, and not those involved with processing and marketing. The number of staff engaged in salmon production during 1985-1995 is given in Table 27.

TABLE 27
Number of staff employed in salmon production in 1985-1995

Year		1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Staff:	full time	402	527	608	991	1,102	1,165	1,014	985	976	1050	1104
	part time	148	206	198	329	316	326	272	275	248	248	251
Total staff		550	733	806	1,320	1,418	1,491	1,286	1,260	1224	1,298	1355

Since 1985 the number of staff employed in salmon production has shown periodic fluctuatations. In 1985-1990 staffing levels increased annually to reach a peak of 1491. During 1991-1993 staffing decreased whilst in 1994 and 1995 it has again increased. The current increase in staffing level, particularly in those in full-time employment, reflects the the increasing number of smolts being put to sea and the increasing tonnages harvested.

Company productivity

An estimate productivity by company in 1995 was obtained by relating production tonnage to manpower employed, companies being grouped according to the tonnage produced as shown in Table 28.

TABLE 28
Productivity (tonnes/man) by companies by scale of production in 1995

Total tonnage	0-50	51-100	101-200	201-300	301-400	401-500	501-700	701-950	951-2,000	<2,000	Total
No companies	29	10	18	20	10	7	9	5	5	7	120
No tonnes	410	725	2,505	4,870	3,497	3,088	5,468	4,114	6,968	38,415	70,060
Manpower (FT)	29	26	51	137	53	48	128	43	81	508	1,104
(PT)	27	17	29	34	17	23	38	14	23	29	251
Manpower (total)	56	43	80	171	70	71	166	57	104	537	1,355
Productivity (tonnes/man)	7	17	31	28	50	43	33	72	67	72	52
Range in production (tonnes/man)	1-19	11-26	19-64	9-67	34-78	28-99	14-200	40-130	38-90	60-151	-

FT = Full time, PT = Part time

The smaller producing companies (ie. producing <200 tonnes) tended to employ proportionally more part-time staff than the larger producing companies. Mean productivity in 1995 was 52 tonnes/man compared with 51 tonnes/man in 1994. It was evident however that productivity in the larger producer companies was markedly greater than in the smaller companies but the ranges in productivity indicated that some of the smaller producers were equally efficient. These data suggest that there is still scope for a number of companies to increase production efficiency.

Production by manpower by Region

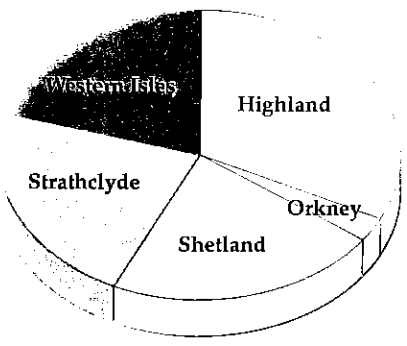
Trends in staffing levels and annual production in each of the Scottish Regions where salmon are produced are shown in Table 29. Highland Region continued to be the largest employer and produced the greatest tonnage in each of the grilse, pre-salmon and salmon categories. Strathclyde, Shetland and Highland Regions ranked second, third and fourth with regard to the tonnage produced, is illustrated in Figure 11. The greatest productivity (64 tonnes per man) was achieved in the Western Isles As indicated elsewhere in this report, production now tends to be controlled by a small number of companies operating a large number of sites which tend to be spread over a number of Regions. Production within a Region tends to be controlled by the large companies growing and harvesting strategies although the small local companies continue to play a significant role in salmon production, particularly in employment, in many of the more remote areas. Production tends to be limited by the availability of sites within Regions. There was no evidence to indicate that growth or survival was greater in any one Region.

TABLE 29
Production and manpower of sea sites by Region in 1992-1995

Region		Staff F/T	Staff P/T	Annual production*	Production (t/man)	Grilse Tonnes	Grilse Nos (000s)	Grilse Mean wt (kg)	Pre-salmon Tonnes	Pre-salmon Nos (000s)	Pre-salmon Mean wt (kg)	Salmon Tonnes	Salmon Nos (000s)	Salmon Mean wt (kg)
Highland	1992	372	63	13,980	32	3,352	1,538	2.17	5,791	2,217	2.61	4,837	1,447	3.34
	1993	372	52	20,279	48	7,177	2,836	2.53	7,225	2,278	3.17	5,800	1,730	3.35
	1994	407	59	25,003	54	7,392	2701	2.74	9,991	2,703	3.70	7,450	1,647	4.52
	1995	401	54	22,509	49	7,291	2,660	2.74	7,433	2,061	3.61	7,686	1,927	4.00
Orkney	1992	35	21	1,046	19	163	67	2.43	412	169	2.43	471	167	2.81
	1993	38	16	1,245	23	212	91	2.33	428	145	2.95	605	208	2.91
	1994	48	19	2,107	31	371	151	2.46	957	328	2.92	780	217	3.59
	1995	58	11	1,903	28	392	147	2.67	849	251	3.38	662	176	3.76
Shetland	1992	213	96	10,679	34	851	332	2.56	4,636	1,680	2.75	5,192	1,335	3.89
	1993	191	116	11,659	38	1,246	488	2.55	6,013	1,854	3.24	4,400	1135	3.88
	1994	193	106	14,278	48	3,371	1,303	2.59	5,967	2,051	2.91	4,918	1,248	3.94
	1995	201	109	15,523	50	4,204	1,299	3.24	6,908	1,756	3.93	4,352	993	4.38
Strathclyde	1992	206	46	6,458	26	1154	569	2.02	2,108	786	2.68	3,196	986	3.24
	1993	199	32	8,675	38	2,107	745	2.83	3,366	922	3.65	3,202	981	3.26
	1994	173	35	13,184	63	3,277	1,169	2.80	4,249	1,131	3.76	5,653	1,182	4.78
	1995	247	51	15,777	53	4,641	1,526	3.04	5,505	1,468	3.75	5,584	1,215	4.60
Western Isles	1992	159	49	3,938	19	1,203	684	1.75	1,703	822	2.07	1,032	380	2.71
	1993	176	32	6834	33	1,998	808	2.45	2,968	934	3.12	1,868	620	3.01
	1994	182	23	9,493	46	2,976	1,110	2.68	3,316	799	4.15	3,011	802	3.75
	1995	197	26	14,348	64	5,707	1,978	2.88	4,845	1,274	3.80	3,632	825	4.40
All Scotland	1992	985	275	36,101	29	6,723	3,190	2.11	14,650	5,675	2.58	14,728	4,315	3.41
	1993	976	248	48,691	40	12,740	4,969	2.56	20,077	6,179	3.24	15,875	4,675	3.40
	1994	1,003	242	64,066	51	17,386	6,435	2.70	24,479	7,011	3.49	21,812	5,096	4.28
	1995	1,104	251	70,060	52	22,235	7,610	2.92	25,540	6,810	3.75	21,916	5,135	4.27

The above excludes small quantitites of young fish (ref. Table 21b) harvested in the year of smolt input in 1993, 1994 and 1995 in Highland, Shetland, Strathclyde and Western Isles Regions.

Figure 11 : Proportion (%) production by Region in 1995



Production systems

Two systems of production are employed, namely seawater cages and shore based tanks. The former are located in and utilise the open sea, the latter are land based and require seawater to be pumped ashore. The number of each system in use, their total production capacity and weight of fish produced plus the ratio of standing cage capacity to weight of fish produced (kgs/m3) are shown in Table 30 and Figure 12.

TABLE 30
System of production, production capacity and tonnes produced in 1992-1995

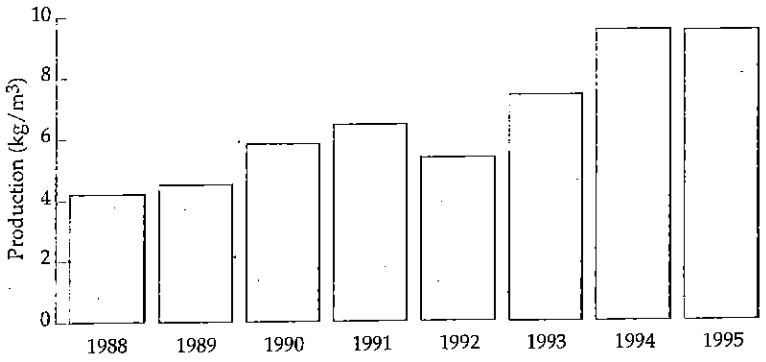
System of production	Number of sites				Total capacity (000s cubic metres)				Production (tonnes)			
	1992	1993	1994	1995	1992	1993	1994	1995	1992	1993	1994	1995
Sea water tanks	8	7	5	5	56	46	23	22	741	668	532	598
Sea water cages	271	276	257	263	6,598	6,482	6,669	7,313	35,360	48,023	63,534	64,462
Total annual production (tonnes)									**36,101**	**48,691**	**64,066**	**70,060**
Ratio of kg produced/m³ standing cage capacity									**5.4**	**7.4**	**9.5**	**9.5**

Seawater cages continued to be the only significant system of production, the tonnage produced by this system having increased from 35,360 in 1992 to 69,462 tonnes in 1995. In 1994 and 1995 the number of tank sites remained static and currently contribute less than 1% of production. Production by this system has always been small compared with cage sites and reflects the high energy costs incurred in its operation.

Production capacity in sea cages in 1995 increased by 9.7% to 7.3 million cubic meters but productivity remained static at 9.5kg fish weight per cubic meter. The increase in capacity was due to the increase in the number of sites in production (263 in 1995, 257 in 1994) and the introduction of larger cage sizes.

While not directly reflecting stocking density and bearing that growth rates are faster, the fact that productivity remained constant in 1994 and 1995 suggests that stocking per unit volume may have reached an optimum level. Farmers are reminded that the currently highly effective controls on disease are more likely to fail as stocking densities increase.

Figure 12 : Production as kilograms produced/m³ standing sea cage capacity in 1985-1995



Scale of production

There has been a tendency for companies to concentrate and increase production at individual sites. This is demonstrated by grouping sites in relation to tonnage produced as shown in Table 31.

TABLE 31
Grouping of salmon production sites in relation to tonnage produced in 1992-1995

Production grouping (tonnes)		Number of sites per production grouping										Total	
		0	<10	10-25	26-50	51-100	101-200	201-300	301-400	401-500	>500	Sites	Tonnes
No of sites	1992	139	6	21	28	48	46	26	8	9	16	347	36,101
	1993	144	9	18	26	44	50	36	11	14	17	369	48,691
	1994	154	4	14	11	31	49	30	15	19	36	363	64,066
	1995	162	4	9	11	23	37	34	17	17	45	359	70,060
% share of production	1992	0.0	0.1	1.1	3.0	10.1	19.6	17.4	8.3	10.9	29.6	-	-
	1993	0.0	0.1	0.7	2.0	6.8	14.4	18.0	7.4	12.9	37.7	-	-
	1994	0.0	+	0.4	0.7	3.8	11.5	11.8	8.1	13.4	50.3	-	-
	1995	0.0	+	0.2	0.6	2.4	7.5	12.0	8.5	10.7	58.0	-	-

In 1995 a total of 45 sites produced >500 tonnes and these sites combined accounted for 58% of the total production. The equivalent figures in 1994, 1993 and 1992 were 36, 17 and 16 sites, accounting for 50%, 38% and 30% of production respectively. Sites producing <100 tonnes in 1995 accounted for only 3.2% of the production compared with 4.9%, 9.6% and 14.3% in 1994, 1993 and 1992.

Broodstock sites

Potential broodstock salmon are generally selected in spring-summer and are held till October-December when they are stripped and fertilised ova then transferred to hatchery sites for ongrowing. The number of seawater sites holding broodstock varies from year to year, as is shown in Table 32.

TABLE 32
Number of sites holding broodstock in 1985-1995

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Broodstock sites	38	35	31	44	35	27	15	21	24	18

In 1995 broodstock were held on 18 sites, a decrease of 6 compared with 1994. These data demonstrate that over 1986-1995 there has been a tendency amongst growers to rear broodstock at specific "broodstock" sites. It should be noted that not all broodstock are stripped at the sea sites, it is common practise to move broodstock some weeks prior to stripping to freshwater sites for acclimation and then stripping. A total of 9,170 fish (female) were stripped, giving rise to 89.6 million ova - an average of 9,770 ova per fish. It is likely that market demand will be the major limiting factor regarding further expansion in this part of the industry rather than the availability of broodstock or broodstock sites.

CONCLUSIONS

The industry continues to grow in terms of production of salmon, staff employed and smolts put to sea. The two most notable features of this years results were the increased survival of the 1993 year class of smolts to 90% and the 24% increase in smolts put to sea. Disease, the most common cause of poor survival in the past, has in general either been absent on many sites or under control. Due to industry and insurers experience losses due to storm damage also continues to decrease.

Smolt survival has increased by approximately 10% per year for the last 3 years and has accounted for the fairly dramatic increase in production from 36,000 tonnes in 1992 to 70,000 tonnes last year with much the same annual smolt input over the intervening period. Feed improvements have also contributed to improved weights at harvest and therefore to the increased tonnages. It is clear that further increases in tonnage on a comparable scale are unlikely to come from further increases in survival and advances in food technology hence it has been recognised that to retain the industry's share of the continuing and increasing consumer demand for salmon more production will only come from further smolt inputs. It is estimated that arising from the increased input of smolts in 1995 production will exceed 80,000 tonnes in 1996.

ALS Munro
JA Gauld
April 1996

ANNUAL RETURN OF INFORMATION FROM SCOTTISH FISH FARMS FOR THE PERIOD 1 JANUARY TO 31 DECEMBER 1995

RAINBOW TROUT - DATA

Please complete and return by 10 January 1996 to J Gauld, SOAEFD Marine Laboratory PO Box 101, Victoria Road, Aberdeen, AB9 8DB

Reg No SF/

Name of site | Please correct site name here (if necessary) | Please correct main method of production on each site (if necessary), ie fresh water cages or tanks

1 **How many staff were employed in trout production (company total)** **Full time** ☐☐ **Part time** ☐☐

		Site 1	Site 2	Site 3	Site 4
2	**How many eyed ova were laid down for hatching in 1995**				
a	from own broodstock	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	from GB broodstock				
c	from abroad (Northern Hemisphere including N Ireland and Isle of Man)	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
d	from abroad (Southern Hemisphere)	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
3	**How many of the above ova were**				
a	all female diploid	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	mixed sex diploid				
c	all triploid				
4	**How many fry/fingerlings were**				
a	bought	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	sold				
5	**How many bought fry/fingerlings were**				
a	all female diploid	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	mixed sex diploid				
c	all triploid				
6	**How many of these fish were vaccinated against ERM**				
a	on site	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	bought vaccinated				
7	**What was your total production in TONNES for the TABLE TRADE**				
a	<450 g (<1 lb)	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	450-900 g (1-2 lb)				
	>900 g (>2 lb)				
8	**What was your total production in TONNES for the RESTOCKING TRADE**				
a	<450 g (<1 lb)	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	450-900 g (1-2 lb)				
c	>900 g (>2 lb)				

Appendix 2

ANNUAL RETURN OF INFORMATION FROM SCOTTISH FISH FARMS FOR THE PERIOD 1 JANUARY TO 31 DECEMBER 1995

ATLANTIC SALMON - SMOLT DATA

Please complete and return by 10 January 1996 to J Gauld, SOAEFD Marine Laboratory PO Box 101, Victoria Road, Aberdeen, AB9 8DB

Reg No SF/

Name of site	Please correct site name here (if necessary)	Please correct main method of production on each site (if necessary) ie fresh water cages or tanks

1 How many staff were employed in smolt production company total) **Full time** ☐☐☐ **Part time** ☐☐☐

2 How many ova were produced in the winter of 1994-1995 (company total) ☐☐☐☐☐☐☐

		Site 1	Site 2	Site 3	Site 4
3	**How many eyed ova were laid down for hatching (winter of 1994-1995)**				
a	From own farmed broodstock	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	From other GB farmed broodstock	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
c	From GB wild broodstock	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
d	From foreign sources	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
4	**How many eyed ova do you expect to hatch this winter (1995-1996)**	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
5	**How many fry or parr were**				
a	Transferred into the site	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	Transferred out of the site	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
6	**How many smolts were produced as**				
a	S1/2 s	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	S1s	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
c	S1 1/2 s	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
d	S2s	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
7	**How many smolts were sold as**				
a	S1s	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	S2s	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
8	**How many smolts do you expect to produce for sea winter on-growing next spring (1996) as**				
a	S1s	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	S2s	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
9	**How many smolts do you plan to produce in the spring of 1997**	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
10	**What is the fish holding capacity of each site in cubic metres**	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
11	**If a FALLOW PERIOD was used in 1995 please indicate duration in WEEKS (cage sites only)**	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
12	**How many fish did you vaccinate**				
a	**against furunculosis**	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐
b	**against ERM**	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐	☐☐☐☐☐

ANNUAL RETURN OF INFORMATION FROM SCOTTISH FISH FARMS FOR THE PERIOD 1 JANUARY TO 31 DECEMBER 1995

ATLANTIC SALMON - PRODUCTION DATA

Please complete and return by 10 January 1996 to J Gauld, SOAEFD Marine Laboratory
PO Box 101, Victoria Road, Aberdeen. AB9 8DB

Reg No SF/

Name of site	Please correct site name here (if necessary)	Please correct main method of production on each site (if necessary), ie sea water cages or tanks

1 **How many staff were employed in salmon production (company total), excluding post-harvest processing staff)** **Full time** ☐☐☐ **Part time** ☐☐☐

		Site 1	Site 2	Site 3	Site 4
2	**How many smolts were put into the site in 1995 as:**				
a	S1/2 s	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
b	S1s	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
c	S1 1/2 s	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
d	S2s	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
3	**How many smolts came from England**	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
4	**Total smolt input proposed in 1996**	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
5	**Harvest of 1994 SMOLT INPUT in 1995**				
a	Number of tonnes	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
b	Number of fish	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
6	**Harvest of 1994 SMOLT INPUT from 1 JANUARY to 31 AUGUST**				
a	Number of tonnes	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
b	Number of fish	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
7	**Harvest of 1994 SMOLT INPUT from 1 SEPTEMBER to 31 DECEMBER**				
a	**Number of tonnes**	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
b	Number of fish	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
8	**Harvest of 1993 SMOLT INPUT**				
a	Number of tonnes	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
b	Number of fish	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
9	**How many tonnes of fish do you expect to produce in 1996**	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
10a	**Were brood fish produced in 1995**	**YES/NO**	**YES/NO**	**YES/NO**	**YES/NO**
b	**How many fish were stripped**	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
11	**What is the current fish holding capacity of each site in cubic metres**	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
12	**Duration of FALLOW PERIOD in WEEKS (cage sites only)**	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐	☐☐☐☐☐☐
13	**Does a management agreement in respect of fish health operate with other producers in your area**	**YES/NO**	**YES/NO**	**YES/NO**	**YES/NO**